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Filip et al.

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(54) **HAND-HELD POWER TOOL**

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CPC B25D 17/04; B25D 2211/068; B25D 2250/121; B25D 2250/261; B25D 17/00; B25F 5/02
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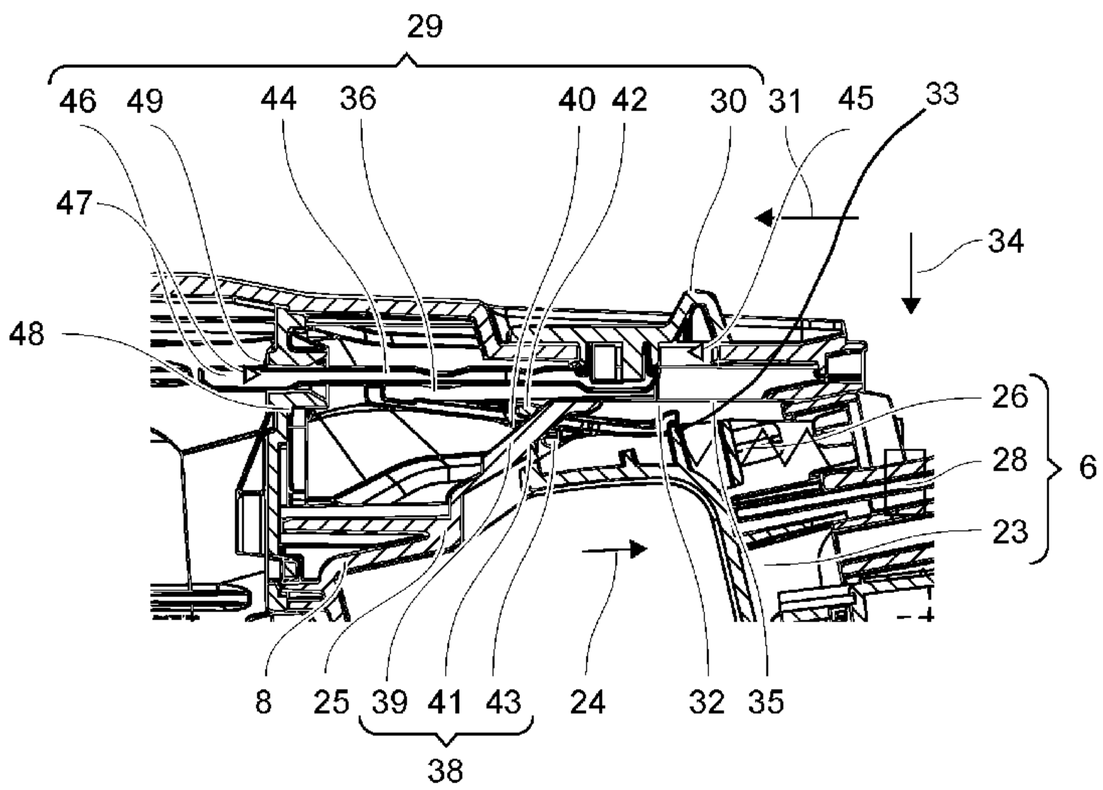
(57) **ABSTRACT**

A handheld power tool has a monostable operating button **6** which has a stable switching position and a pressed switching position. A catch **32** which can be pivoted between a releasing position and a locking position in a pivoting direction **34** is provided, wherein the catch **32**, in the locking position, stops the monostable operating button **6** in the pressed switching position. An operating knob **30** can be moved by the user in a shifting direction **31** which is perpendicular to the pivoting direction **34**. The catch **32** is attached to the operating knob **30** by means of a joint **36**. A slotted link **38** converts a movement of the catch **32** along the shifting direction **31** into a pivoting movement in the pivoting direction **34**.

18 Claims, 3 Drawing Sheets



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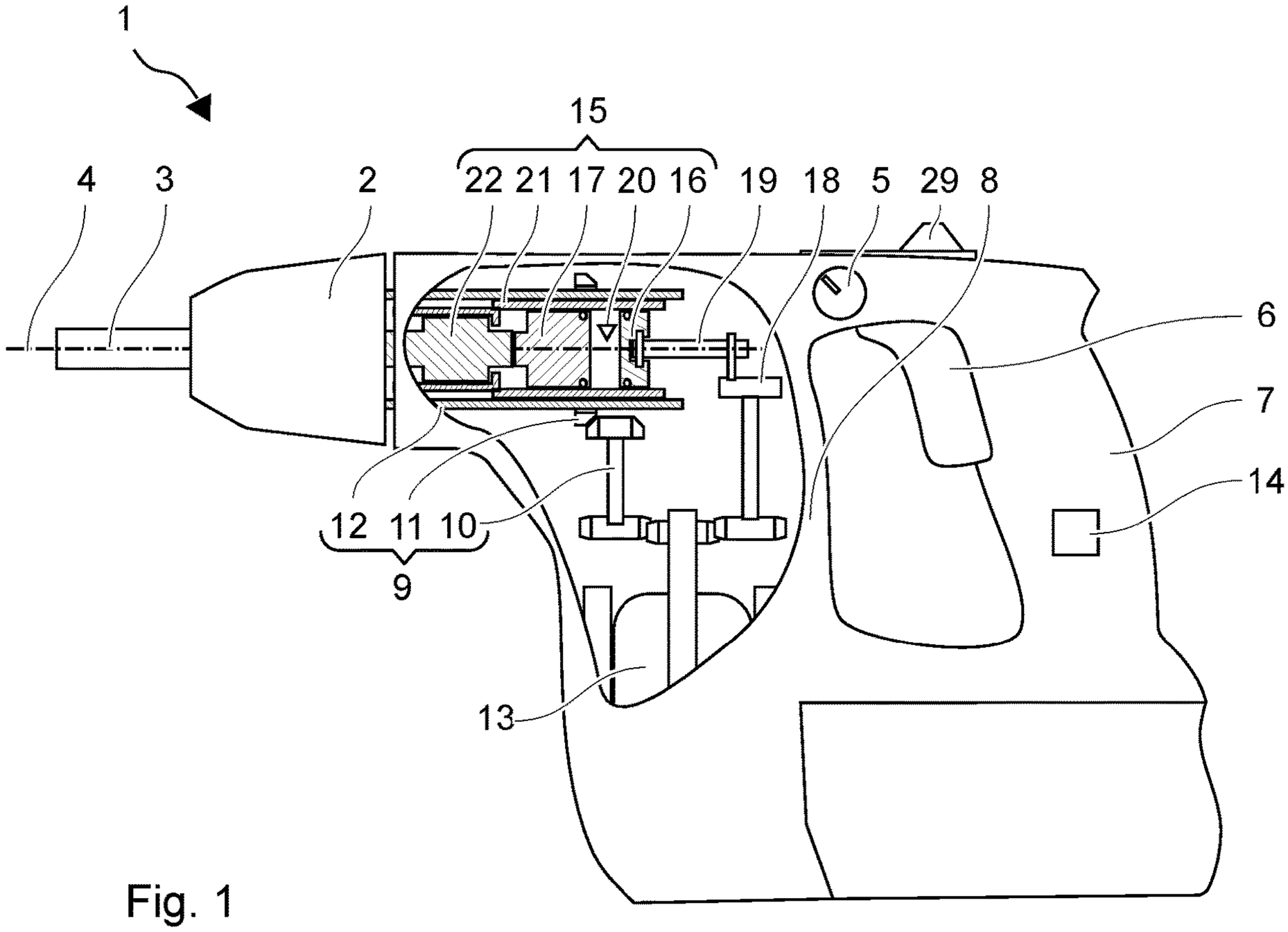

Fig. 1

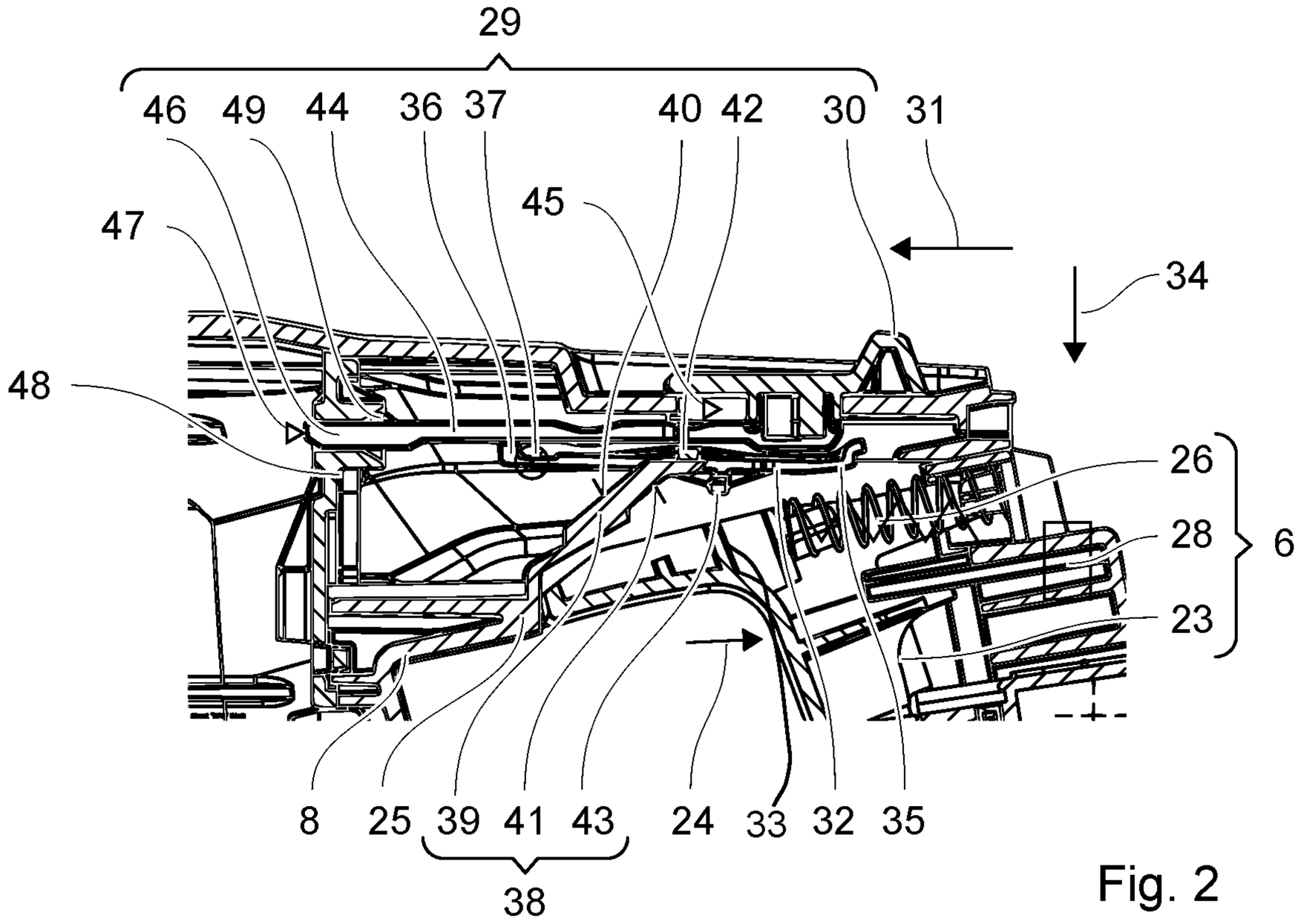
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Fig. 2

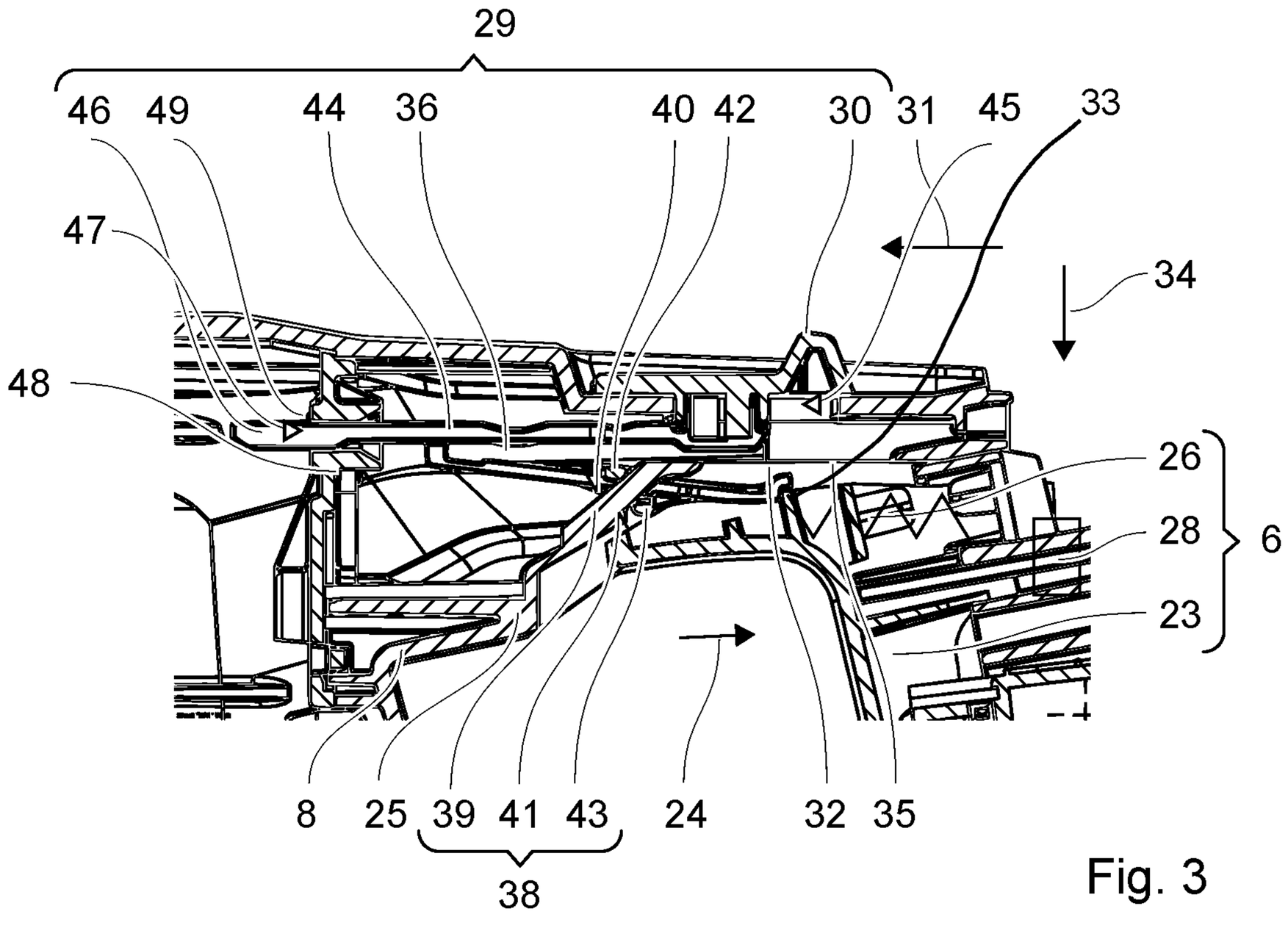
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Fig. 3

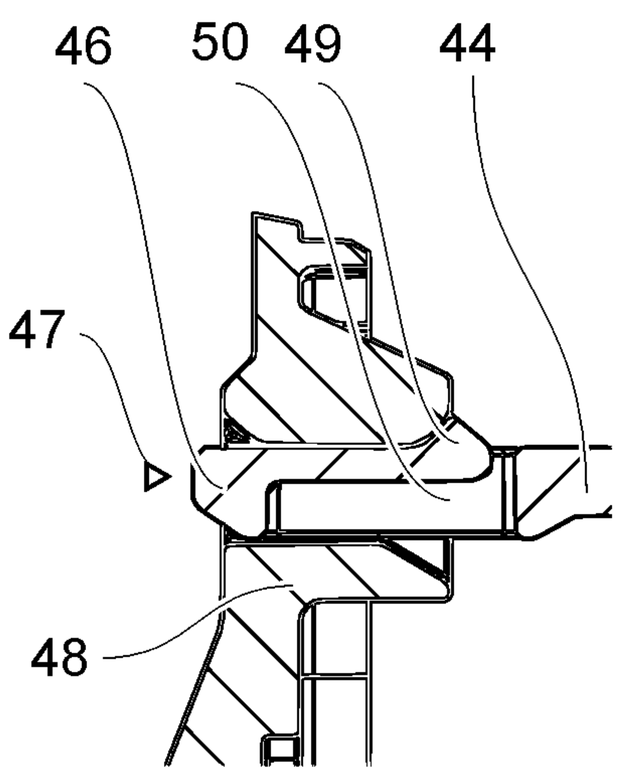

Fig. 4

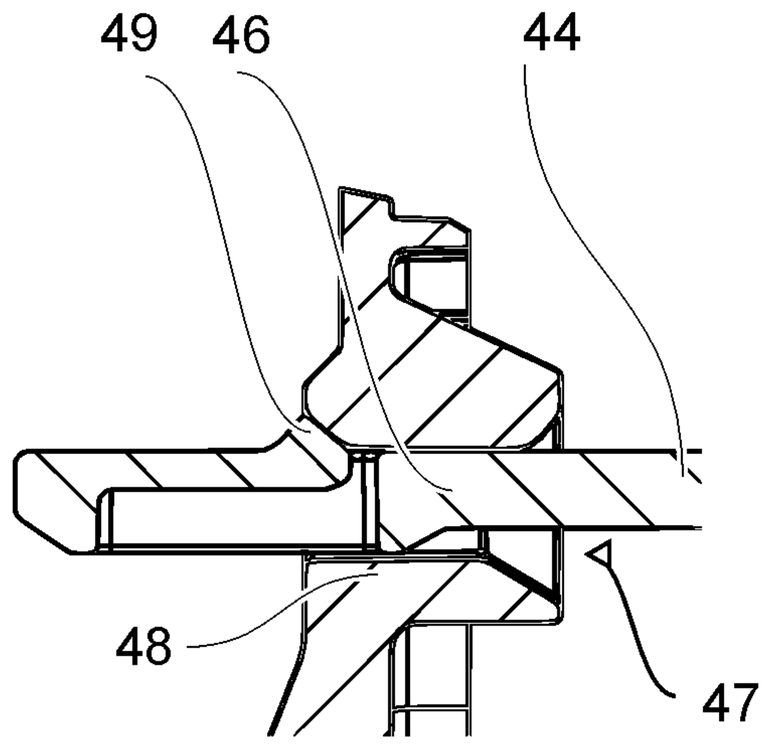

Fig. 5

HAND-HELD POWER TOOL

FIELD OF THE INVENTION

The invention relates to a handheld power tool which has a mechanism for locking an operating button in an operated position.

SUMMARY OF THE INVENTION

One embodiment of a handheld power tool has a tool holder for holding a tool, a percussion mechanism, an electric motor for driving the percussion mechanism, a monostable operating button which has a stable switching position and a pressed switching position, and a device controller which switches off the electric motor in response to the stable switching position and which activates the electric motor in response to the pressed switching position. A catch is provided, which catch can be pivoted between a releasing position and a locking position in a pivoting direction, wherein the catch, in the locking position, stops the monostable operating button in the pressed switching position. An operating knob can be moved by the user in a shifting direction which is perpendicular to the pivoting direction. The catch is attached to the operating knob by means of a joint. A slotted link converts a movement of the catch along the shifting direction into a pivoting movement in the pivoting direction.

One advantage of the catch for locking the operating button is its simple assembly. The catch and the associated operating knob form one physical unit which can be installed in a single assembly step. The associated slotted link can be part of a housing of the handheld power tool or can be integrally formed on the housing.

BRIEF DESCRIPTION OF THE DRAWINGS

The following description explains the invention on the basis of exemplary embodiments and figures, in which:

FIG. **1** shows a hammer drill

FIG. **2** shows an inoperative position of the operating button

FIG. **3** shows a locked position of the operating button

FIG. **4** shows a partial illustration of FIG. **3**

FIG. **5** shows a partial illustration of FIG. **4**

Identical or functionally identical elements are indicated by the same reference symbols in the figures, unless stated otherwise.

DETAILED DESCRIPTION

FIG. **1** schematically shows a hammer drill **1** as an example of a portable handheld power tool. The exemplary hammer drill **1** has a tool holder **2** into which a tool **3** can be inserted and locked. The tool **3** is, for example, a drill, a chisel etc. The embodiment illustrated by way of example turns the tool holder **2** about a working axis **4** and at the same time periodically strikes the tool along the working axis **4**. The handheld power tool **1** can have a mode selector switch **5** which allows the user to selectively activate and deactivate the rotational movement and selectively activate and deactivate the percussive operation. The user can operate the handheld power tool **1** by way of a monostable operating button **6**.

The handheld power tool **1** has a handle **7**. The user can hold and control the handheld power tool **1** during operation by way of the handle **7**. The operator switch **6** is preferably

attached to the handle **7** in such a way that the user can operate the operating switch **6** using the hand holding the handle **7**. The handle **7** can be decoupled from a machine housing **8** by means of damping elements.

The handheld power tool **1** has a rotary drive **9** which is coupled to the tool holder **2**. The rotary drive **9** can have, amongst other things, a step-down gear mechanism **10** and a slip clutch **11**. An output shaft **12** of the rotary drive **9** is connected to the tool holder **2**. The rotary drive **9** is coupled to an electric motor **13**. The user can switch on and switch off the electric motor **13** by operating the operating button **6**, wherein the operating button **6** accordingly controls a power supply to the electric motor **13**. In one embodiment, a rotation speed of the electric motor **13** can be adjusted by means of the operating button **6**. A device controller **14** detects the position of the operating button **6** and actuates the electric motor **13** in response.

The handheld power tool **1** has a pneumatic percussion mechanism **15**. The pneumatic percussion mechanism **15** has an exciter piston **16** and a percussion piston **17**. The exciter piston **16** is rigidly coupled to the electric motor **13**. An eccentric gear **18** and a connecting rod **19** transform the rotational movement of the electric motor **13** into a translatory movement on the working axis **4**. The exciter piston **16** and the percussion piston **17** close off a pneumatic chamber **20** between them. In the illustrated embodiment, radial closure of the pneumatic chamber **20** is provided by a guide tube **21** which at the same time guides the exciter piston **16** and the percussion piston. In other embodiments, the percussion piston can be of hollow design and the exciter piston **16** is guided in the percussion piston, or vice versa. The air enclosed in the pneumatic chamber **20** is compressed and decompressed by the exciter piston **16**. The change in pressure couples the percussion piston to the movement of the exciter piston **16**, and the pneumatic chamber **20** behaves similarly to a spring, and is therefore also called a pneumatic spring. The percussion piston **17** can strike the tool **3** directly or strike the tool indirectly by means of an anvil **22**.

The handheld power tool **1** is switched on and switched off by the operating button **6**. The operating button **6** is arranged in the handle **7**. The operating button **6** has a switching cap **23** (see, e.g. FIGS. **2** and **3**) which the user can grip. The switching cap **23** protrudes from the handle **7** counter to a switching direction **24** in an inoperative position of the operating button **6** (FIG. **2**). The switching cap **23** preferably bears against a stop **25** of the machine housing **8**. The user can press the switching cap **23** into a pressed switching position in the switching direction **24** (FIG. **3**). In the process, the switching cap **23** can slide or pivot into the handle **7**. The switching cap **23** can be pivoted about a bearing point, as in the illustrated example, or can be linearly guided. The switching cap **23** is at a distance from the stop **25**. The switching cap **23** is acted on by a restoring element **26**, for example a helical spring, with a force which acts counter to the switching direction **24**. The restoring element **26** is tensioned to a greater extent in the pressed switching position than in the inoperative position, as a result of which the switching cap **23** is stable only in the inoperative position. The switching cap **23** returns to the inoperative position when the user releases the switching cap **23**. The switching direction **24** is preferably antiparallel to the working direction **27** in which the tool **3** faces.

The switching cap **23** is coupled to a switching mechanism **28** of the operating button **6**. The switching mechanism **28** deactivates the electric motor **13** when the switching cap **23** is in the inoperative position. The switching mechanism **28** activates the electric motor **13** when the switching cap **23**

is in the pressed position. The switching mechanism **28** can comprise an electromechanical, optical, magnetic or other sensor for determining the position of the switching cap **23**. In one embodiment, the switching mechanism **28** can adjust a rotation speed or power consumption of the electric motor **13** depending on positions which are pressed to different extents.

The handheld power tool **1** has a locking switch **29**. The locking switch has a releasing position (FIG. **2**) and a locking position (FIG. **3**).

The locking switch **29** has an operating knob **30** which can be gripped by the user. The user can move the operating knob **30** between a first position and a second position in shifting direction **31**. The first position is associated with the releasing position of the locking switch **29** and the second position is associated with the locking position of the locking switch **29**. The shifting direction **31** is preferably antiparallel to the switching direction **24** of the operating button **6**.

The locking switch **29** has a pivotable catch **32** which engages into the switching cap **23** in the locking position. The catch **32** stops the movement of the switching cap **23** counter to the switching direction **24** and therefore stops the switching cap **23** from returning to the inoperative position. The operating button **6** remains in the pressed switching position. The electric motor **13** remains activated, even if the user releases the switching cap **23**.

The catch **32** interacts with the switching cap **23**. The switching cap **23** has a locking area **33** against which the catch **32** can bear in the locking position. The locking area **33** can be realized by the outer contour of the switching cap **23** or by a rib which is accessible from the outside, or the like. The locking area **33** is preferably largely perpendicular to the switching direction **24**. The locking area **33** faces away from the switching direction **24** and in the direction of the catch **32**.

The catch **32** can be pivoted in a pivoting direction **34** which is perpendicular to the switching direction **24**. The catch **32** can be pivoted between a first position, which is associated with the releasing position, and a second position, which is associated with the locking position, in the switching direction **24**. The catch **32** does not overlap with the blocking area **33** in the releasing position. The overlap relates to the switching direction **24**, i.e. the overlap can be determined perpendicular to the switching direction **24** in the projection onto a plane. The catch **32** overlaps with the stop **33** in the locking position. A tip **35** of the catch **32** bears against the locking area **33** in the switching direction **24**. Similarly to the gripping hand, the tip **35** exerts a counterforce to the restoring element, as a result of which the operating switch **6** remains pressed.

The position of the tip **35** along the switching direction **24** corresponds to the position of the stop **33** along the switching direction **24** when the operating button **6** is pressed. The tip **35** can protrude beyond the stop **33** in the switching direction **24** when the operating button **6** is in the inoperative position. The locking switch **29** is inoperable when the handheld power tool **1** is switched off.

The catch **32** is fastened to the operating knob **30** in a resilient manner. A joint **36** connects the operating knob **30** and the catch **32**. The joint **36** can be pivoted about an axis **37** which is perpendicular to the pivoting direction **34**. The joint **36** is preferably designed as a flexure bearing. The joint **36** consists of the same material as the catch **32** and preferably as the operating knob **30**. The joint **36** has a lower rigidity than the catch **32** in the pivoting direction **34**. The low rigidity is realized by a low thickness, i.e. smaller dimension along the pivoting direction **34**. The joint **36** can reversibly, possibly elastically, deform provided that the catch **32** can be pivoted between the locking and releasing position. The joint **36** is preferably tensioned in the locking position and free of force in the releasing position.

A slotted link **38** pivots the catch **32** in response to the position of the operating knob **30**. The slotted link **38** comprises a rail **39**, which runs in an inclined manner, on the machine housing **8**. The rail **39** rises in the pivoting direction **34** along the shifting direction **31**. The rail **39** has, with respect to the pivoting direction **34**, a lower guide face **40** and an upper guide face **41**. In the example, the lower guide face **40** faces the operating knob **30**; the upper guide face **42** is averted from the operating knob **30**. The catch **32** has a lower finger **42** which runs on the lower guide face **40** and an upper finger **43** which runs on the upper guide face **42**. In the event of a movement of the operating knob **30** in the shifting direction **31**, the upper finger **43**, in order to follow the upper guide face **41**, pulls the catch **32** in the pivoting direction **34**. In the event of a movement counter to the shifting direction **31**, the lower finger **42**, in order to follow the lower guide face **40**, presses the catch **32** against the pivoting direction **34**.

The joint **36** is preferably arranged offset in relation to the slotted link **38** in the shifting direction **31**. The joint **36** is deflected between the releasing position and the locking position through a maximum of 10 degrees. This is rendered possible, amongst other things, on account of the catch **32** being fastened to the operating knob **30** by means of the joint **36** and in this way being displaced along the shifting direction **31** with the operating knob **30**.

The operating knob **30** can have a carrier rod **44**. The carrier rod **44** is oriented along the shifting direction **31** and suspended in a manner guided such that it can move along the shifting direction **31**. The operating knob **30** is fastened at one end of the carrier rod **44**. The operating knob **30** is mounted at an aperture **45** in the machine housing **8**. The other end of the carrier rod **44** has a head **46** which is mounted in an eyelet **47** such that it can move along the shifting direction **31**. The eyelet **47** can be provided, for example, in a plate **48** which is perpendicular to the shifting direction **31**. The joint **36** is preferably fitted between the operating knob **30** and the head **46**.

The head **46** can have a resilient latching lug **49** (FIG. **4**, FIG. **5**). The latching lug **49** creates a pressure point when the user moves the operating knob **30** between the releasing position and the locking position, and vice versa. The resilient latching lug **49** protrudes in relation to the hollow cross section of the eyelet **47** in the unloaded state. The latching lug **49** is deflected when the latching lug **49** is pushed through the eyelet **47**. The latching lug **49** can pivot into a hollow space **50** in the head **46**. The latching lug **49** is prestressed in the hollow space. On the other side of the eyelet **47**, the prestress ensures said latching lug pivots out of the hollow space, as a result of which the latching lug **49** again protrudes in relation to the hollow cross section of the eyelet **47**.

What is claimed is:

1. A handheld power tool comprising:

a tool holder for holding a tool;

a percussion mechanism;

an electric motor for driving the percussion mechanism;

a monostable operating button having a stable switching position and a pressed switching position;

a device controller switching off the electric motor in response to the stable switching position and activating the electric motor in response to the pressed switching position;

a catch pivotable between a releasing position and a locking position in a pivoting direction, the catch, in the locking position, stopping the monostable operating button in the pressed switching position;

an operating knob movable by the user in a shifting direction perpendicular to the pivoting direction;

a joint, the catch attachable to the operating knob via the joint, the joint fastening the catch to the operating knob in both the releasing and the locking position; and

a link converting a movement of the catch along the shifting direction into a pivoting movement in the pivoting direction.

2. The handheld power tool as recited in claim **1** wherein the link has a rail arranged on a machine housing, the rail being inclined in relation to the shifting direction, and the catch having at least one finger resting on the rail.

3. The handheld power tool as recited in claim **1** wherein the joint is pivotable about an axis perpendicular to a plane spanned by the shifting direction and the pivoting direction.

4. The handheld power tool as recited in claim **1** wherein the joint is a flexure bearing made of a same material as the operating knob.

5. The handheld power tool as recited in claim **1** further comprising a carrier rod guided to move along the shifting direction, the operating knob being guided at one end of the carrier rod and an other end of the carrier rod being guided in an eyelet, the joint being arranged on the carrier rod between the one end and the other end.

6. The handheld power tool as recited in claim **5** further comprising a resilient latching lug at the other end, the latching lug protruding in relation to a hollow cross section of the eyelet in the unloaded state.

7. The handheld power tool as recited in claim **1** wherein the catch is fastened to the operating knob in a resilient manner via the joint.

8. The handheld power tool as recited in claim **1** wherein the joint is made of a same material as the catch.

9. The handheld power tool as recited in claim **8** wherein the joint is made of a same material as the operating knob.

10. The handheld power tool as recited in claim **1** wherein the joint is made of a same material as the operating knob.

11. The handheld power tool as recited in claim **1** wherein the joint has a lower rigidity than the catch in the pivoting direction.

12. The handheld power tool as recited in claim **11** wherein the joint has the lower rigidity than the catch in the pivoting direction due to a lower thickness than the catch along the pivoting direction.

13. The handheld power tool as recited in claim **1** wherein the joint is reversibly deformable.

14. The handheld power tool as recited in claim **13** wherein the joint is reversibly deformable as the catch is pivoted between the locking and releasing position.

15. The handheld power tool as recited in claim **14** wherein the joint is tensioned in the locking position and free of force in the releasing position of the catch.

16. A handheld power tool comprising:

a tool holder for holding a tool;

a percussion mechanism;

an electric motor for driving the percussion mechanism;

a monostable operating button having a stable switching position and a pressed switching position;

a device controller switching off the electric motor in response to the stable switching position and activating the electric motor in response to the pressed switching position;

a catch pivotable between a releasing position and a locking position in a pivoting direction, the catch, in the locking position, stopping the monostable operating button in the pressed switching position;

an operating knob movable by the user in a shifting direction perpendicular to the pivoting direction;

a joint, the catch attachable to the operating knob via the joint; and

a link converting a movement of the catch along the shifting direction into a pivoting movement in the pivoting direction;

wherein the joint is a flexure bearing made of a same material as the operating knob.

17. A handheld power tool comprising:

a tool holder for holding a tool;

a percussion mechanism;

an electric motor for driving the percussion mechanism;

a monostable operating button having a stable switching position and a pressed switching position;

a device controller switching off the electric motor in response to the stable switching position and activating the electric motor in response to the pressed switching position;

a catch pivotable between a releasing position and a locking position in a pivoting direction, the catch, in the locking position, stopping the monostable operating button in the pressed switching position;

an operating knob movable by the user in a shifting direction perpendicular to the pivoting direction;

a joint, the catch attachable to the operating knob via the joint; and

a link converting a movement of the catch along the shifting direction into a pivoting movement in the pivoting direction;

wherein the joint has a lower rigidity than the catch in the pivoting direction.

18. The handheld power tool as recited in claim **17** wherein the joint has the lower rigidity than the catch in the pivoting direction due to a lower thickness than the catch along the pivoting direction.

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